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Response of Shaver Brown Laying Hens to Different Feeding Space Allowances

S.S. Diarra and A. Devi

Department of Animal Science, School of Agriculture and Food Technology,
Alafua Campus, University of the South Pacific, Alafua, Apia, Samoa

Abstract: Three hundred 18 week-old Shaver Brown pullets ($1,477.40 \pm 7.41$ g) were allotted to 5 treatment groups containing 3 replicates of 20 pullets each. The treatments consisted of five feeding space allowances (FSA): 5.60, 8.40, 11.20, 14.00 and 16.80 cm/bird. Data were collected on feed consumption, weight change, egg production and feed conversion ratio (feed: dozen eggs) for a period of 20 weeks (18 to 38 weeks of age). All data collected were subjected to analysis of Variance (ANOVA) and significant differences reported at 5% probability. Mean feed consumption, body weight change and egg weight were not significantly affected by FSA. Pullets given access to FSA of 11.20, 14.00 and 16.80 cm/bird laid the first egg at a significantly younger age compared to those given 5.60 and 8.40 cm/bird. Hen-day egg production (HDP) and egg mass increased with increasing FSA up to 14.00 cm/bird. Hen-day production did not differ between the groups given 8.40 and 16.8 cm/bird. Groups given 5.60 cm/bird consumed more feed per dozen egg produced. The lowest feed consumption per dozen eggs was recorded on 11.20 and 14.00 cm FSA per bird. These results suggest that keeping the feeding space between 11.00 and 14.00 cm/hen will improve flock uniformity and reduce cost of egg production of Shaver Brown hens in the study area.

Key words: Feeding space, welfare, flock uniformity, egg production

INTRODUCTION

The gradual ban of the cage system of poultry production due to welfare issues will increase the need to adopt the litter system. However, even on the deep litter system of management, several welfare issues need to be given due consideration in order to optimize productivity of laying hens. Among several issues, provision of adequate feeding space has both welfare and economic implications in commercial poultry raised under confinement.

Feeder space allowance (FSA) has been reported to influence the incidence of antagonistic behaviour, growth performance and feed utilization in broilers (Cunningham, 1981; Oluyinka *et al.*, 2002) and hen-day egg production in broiler breeder hens (Leksrisompong *et al.*, 2014). Sogunle *et al.* (2014) also reported the effect of FSA and feeder shape on agonistic behaviour (head pecks, pushes and chases) in cockerel chickens. Under these aggressive conditions timid birds usually stay away from the feed and grow slower than average while stronger ones tend to over consume and grow heavier than expected. Both overweight and underweight adversely affect the performance of laying hens. In addition, in hot environments, birds need enough space around them to be able to dissipate more body heat and cope with high environmental temperatures.

There are general recommendations for FSA in the tropics for egg-type hens (Anderson and Adams, 1992; Smith, 2001; Jadhav and Siddiqui, 2010). However, as

body size (an important factor affecting space requirement) varies among breeds, it would be interesting to research into optimum feeding space allowance for different breeds of egg-type chickens. The present study was conducted to investigate the effect of varying feeding space allowances on the performance of Shaver Brown laying hens, the only egg-type breed used at the moment in Samoa.

MATERIALS AND METHODS

Experimental site birds and management: The study was conducted at the Poultry Unit of the University of the South Pacific's School of Agriculture and Food Technology, Alafua Campus, Upolu Island, Samoa. The temperature and relative humidity during the experiment ranged from $29.9-32.2^{\circ}\text{C}$ (31.05 ± 1.19) and 69-90% (79 ± 10.50), respectively.

A total of 300 shaver brown pullets aged 18 weeks and weighing $1,477.40 \pm 7.41$ g ($\text{CV} = 0.41\%$) were allotted to 15 floor pens (2.30×3.40 m) containing 20 pullets each. The floor in each pen was covered with wood shaving (12 cm deep) as litter material. One of the following FSA (5.6, 8.4, 11.2, 14 and 16.8 cm/bird) was provided in 3 randomly selected pens. A pullet grower feed (15% crude protein and 2850 kcal ME/kg) was fed for the first week (week 19-20) and layer feed (16.5% crude protein and 2,850 kcal ME/kg) fed *ad-libitum* from week 21 to the end of the experiment (33 weeks of age). Feed (from wooden trough feeders) and clean drinking water (from

Corresponding Author: S.S. Diarra, Department of Animal Science, School of Agriculture and Food Technology, Alafua Campus, University of the South Pacific, Alafua, Apia, Samoa

bell-shape drinkers) were supplied *ad-libitum* during the experimental period. Birds in all treatments received 13 hours day light throughout the duration of the study. Birds were managed in compliance with the University's research ethics guidelines for animal welfare.

Data collection and analysis: Data were collected on feed consumption, weight change, egg production, feed conversion ratio (feed: dozen eggs) and flock uniformity. Weighed quantities of feed were fed daily and feed intake estimated as the difference between the quantity fed and the refusal the next day. The age of the birds at first egg (days) was recorded per pen. All eggs laid per pen were collected, counted and weighed daily using a digital weighing balance sensitive to 0.01 g. Hen-day production (HDP) was calculated as:

$$\text{HDP} = \frac{\text{Eggs collected}}{\text{Hens present}} \times 100$$

Egg mass (EM) was calculated as:

$$\text{EM (g)} = \text{Eggs collected} \times \text{mean egg weight (g)}$$

Feed conversion ratio was calculated as:

$$\text{FCR} = \frac{\text{Feed consumed (kg)}}{\text{Dosen eggs produced}}$$

Birds were weighed at the beginning and end of the experiment and flock uniformity assessed using the coefficient of variation (CV) calculated as:

$$\text{CV} = \frac{\text{STD}}{\text{Mean weight}} \times 100$$

where, STD is the standard deviation.

Data collected were subjected to one-way ANOVA using the Statistical Package for Social Sciences (SPSS, 2013). Significant differences between means were reported at 5% probability.

RESULTS AND DISCUSSION

Mean feed consumption and body weight change (Table 1 and Fig. 1) were not significantly ($p>0.05$) affected by FSA. Although the mean final body weight was similar among treatments, final body weight of birds in the groups given 5.6 and 8.4 cm varied within wide ranges with higher coefficient of variation (CV) within group compared to those having 11.2, 14 and 16.8 cm feeding space per bird. Birds given 5.6 and 8.4 cm feeding space allowances had CV higher than the 10% recommended for a uniform flock (Ensminger, 1992) indicating poor uniformity on these groups probably as a result of competition for feed as earlier reported by

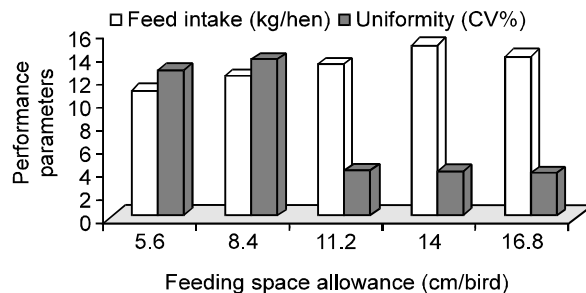


Fig. 1: Effects of feeding space allowance on feed intake and uniformity (CV%) of a shaver brown flock

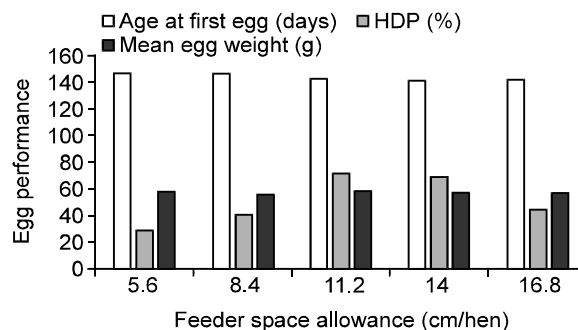


Fig. 2: Effect of feeding space allowance on laying performance of shaver brown hens

Sogunle *et al.* (2014). Under competitive feeding conditions, stronger birds normally over consume with weaker ones having less access to feed and grow less uniform. Leksrisompong *et al.* (2014) also observed that broiler breeder hens having access to 10.4 cm grew more uniform and came into production earlier than those given 7 cm FSA per bird.

From the egg performance data of the hens (Table 2 and Fig. 2) pullets having access to FSA of 11.2, 14 and 16.8 cm/bird laid the first egg at a significantly ($p<0.05$) younger age compared to those given 5.6 and 8.4 cm/bird. There was no marked treatment effect on egg weight but hen-day production (HDP) and egg mass increased markedly ($p<0.05$) with increasing FSA, peaked from 11.2 cm and later declined above 14 cm. There was no marked ($p>0.05$) difference in HDP between the groups given 8.4 and 16.8 cm FSA per bird despite the higher uniformity ($\text{CV} = 3.82$) of the latter group.

Flock uniformity is well known to be an important factor influencing the performance of laying hens. Abbas *et al.* (2010) studied the effect of body weight uniformity on laying performance and concluded that broiler breeder hens with high uniformity had the highest hen-day and hen-house production compared to less uniform groups. In another study, Petitte *et al.* (1982) observed that egg production increased with flock uniformity in broiler breeders. North (1980) also reported that hens

Table 1: Weight changes in laying hens having access to different FSAs

Parameters	Space allowance (cm/bird)					SEM
	5.6	8.4	11.2	14	16.8	
Mean initial weight (g/hen)	1,481.7	1,476.3	1,475.7	1,478.3	1,475.5	4.96
Ranges of initial weight (g/bird) and CV (%)	1475-1490 (0.42)	1477-1488 (0.31)	1470-1487 (0.540)	1473-1489 (0.44)	1468-1487 (0.58)	0.95
Mean final weight (g/hen)	1,985	1,941.5	1950	1,937	1,965	20.29
Mean feed consumption (kg/hen)	11.1	12.2	13.3	15	14	0.44
Mean weight change (g/hen)	490	527.3	555	521.3	517.3	22.25
Ranges of final weight (g/hen) and CV (%)	1.730-2.240 (12.846) ^a	1.673-2.210 (13.830) ^a	1.870-2.030 (4.102) ^b	1.859-2.015 (4.026) ^b	1.890-2.040 (3.817) ^b	0.58

SEM: Standard error of the mean (n = 3); a, b: Means within the row bearing different superscripts differ significant (p<0.05)

Table 2: Laying performance of Shaver Brown hens with access to different FSAs

Parameters	Space allowance (cm/bird)					SEM
	5.60	8.40	11.20	14.00	16.80	
Age at first egg (days)	146.3 ^a	146.3 ^a	142 ^b	141 ^b	142 ^b	0.99
Hen-day production (%)	30 ^c	40.6 ^b	72.2 ^a	69.1 ^a	45 ^c	2.78
Mean egg weight (g)	58.57	57.13	58.29	58	57.48	0.93
Mean egg production (dozens/hen)	3.5 ^c	4.74 ^b	8.42 ^a	8.1 ^a	5.3 ^b	0.32
Egg mass (kg/hen)	2.47 ^c	3.24 ^b	5.9 ^a	5.61 ^a	3.62 ^b	0.26
Feed conversion ratio (feed: dozen eggs)	3.2 ^a	2.6 ^b	1.6 ^c	1.9 ^c	2.7 ^b	0.13

with high uniformity reach peak egg production earlier than those with low uniformity. Similar observations were also made by Hudson *et al.* (2000, 2001). These findings are in agreement with the results of the present experiment. The similarity in feed consumption among the groups and the higher HDP on the 11.2 and 14 cm FSA groups resulted in significantly lowered feed: dozen egg in these groups. Although increasing feeding space allowance was reported to improve flock uniformity and reduce agonistic behaviour in cockerels (Sogunle *et al.*, 2014), FSA above 14 cm/bird did not improve egg performance in the present study. Given more space around the feeder than required, birds might move frequently in an attempt to change position around the feeder. The reduced HDP above 14 cm FSA despite the higher uniformity may be attributed to the diversion of energy by birds for movement rather than production purposes. These results suggest that flock uniformity and efficiency of energy use are the underlying factors affecting performance of laying hens given different feeding space allowances. Similar range (12-15 cm) to these findings has been recommended as optimum for egg-type laying hens generally (Smith, 2001; Jadhav and Siddiqui, 2010). However, as both body size and temperament vary with breed of bird there is need to look into breed differences in feeding space requirement. It was concluded that performance of Shaver Brown hens in the study area will be optimized when feeding space allowance is kept between 11 and 14 cm/hen. Below and above this range, percent hen-day egg production is adversely affected.

Welfare implications: Provision of adequate feeding space has both welfare and economic significance. Access to adequate space will allow performance of natural behaviours and minimize aggression which

adversely affects feed utilization and performance. Farmers in the area could use this information to optimize laying performance of the breed and save cost on feed troughs. In view of the welfare and economic significance of feeding space in commercial farming systems further studies, especially on seasonal variations, are recommended.

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